

**BEST BRAIN EXAMINATIONS KONSORTIUM**  
**SPECIAL PRIVATE MOCK FOR BECE CANDIDATES- APRIL 2022**  
**MARKING SCHEME - MATHEMATICS**

**PAPER 2 [60 MARKS]**

**GENERAL NOTES ON PAPER II**

1. Marks are subdivided into marks for method (M), for accuracy (A) and for accuracy not preceded by M mark (B).
2. The M marks should be given for a particular stage if the method is correct, that is, it would yield the right answer, if correctly carried out without numerical errors. M marks are not generally subdivided and unless the M mark for a preceding stage has been awarded, no A marks can be gained for that stage. (*No deduction should be made from M marks*).
3. Deduct 1 mark for omission of units or for wrong units not more than once in one whole question.
4. Give '0' (zero) for results obtained for work that is indecipherable or wholly suppressed.
5. If more questions are attempted than the rubric allows, delete the marks given for these extra questions which have the lowest marks. This rule implies that for candidates attempting more than four questions, consider only their best four and ignore the remaining questions by writing "MQA". (*MQA denotes More Questions Answered than allowed by rubrics*)
6. Do not mark beyond the first appearance of a correct answer, i.e. ignore any further work beyond the correct answer

**QUESTION ONE**

(a)  $P = \{2, 3, 5, 7, 11, 13, 17, 19\}$   
 $Q = \{1, 3, 5, 7, 9\}$

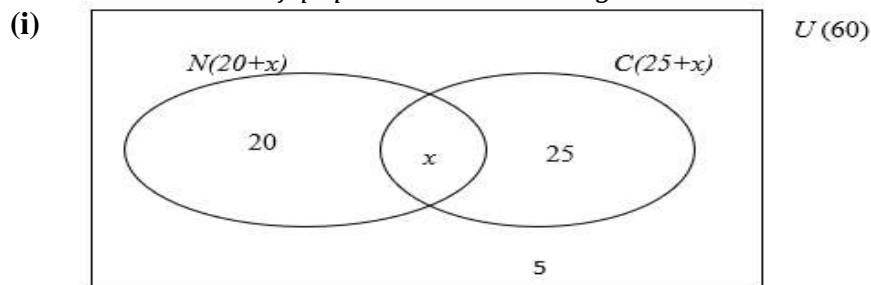
(i)  $P \cap Q = \{3, 5, 7\}$

(ii)  $P \cup Q = \{1, 2, 3, 5, 7, 9, 11, 13, 17, 19\}$

(iii)  $P \cap Q^c = \{2, 11, 13, 17, 19\}$

**B**<sup>1</sup>/<sub>2</sub>  
**B**<sup>1</sup>/<sub>2</sub>  
**B**<sup>1</sup>/<sub>2</sub>

- (b) Given Number of pupils who like reading Novels but not Comics = 20  
 Number of pupils who like reading Comics but not Novels = 25  
 Number of pupils who like reading neither Comics nor Novels = 5  
 Let  $U$  = Universal set of all pupils  
 $C$  = number of pupils who like reading comics  
 $N$  = number of pupils who like reading novels  
 $x$  = number of pupils who like reading both novels and comics



**B1**

(ii) For the value of  $x$   
 $20 + x + 25 + 5 = 60$   
 $20 + 25 + 5 + x = 60$   
 $50 + x = 60$   
 $x = 60 - 50$   
 $x = 10$

**B2**

**M1**

Both Novels and Comics = **10 pupils**

(iii)  $C = x + 25$   
 $= 10 + 25$   
 $= \mathbf{35 \text{ pupils}}$

**M1**

**A**<sup>1</sup>/<sub>2</sub>

$\therefore$  35 pupils like reading Comics

(iv)  $N = x + 20$   
 $= 10 + 20$   
 $= \mathbf{30 \text{ pupils}}$

**M1**

**A**<sup>1</sup>/<sub>2</sub>

$\therefore$  30 pupils like reading Novels

**B1**

(c) (i)  $100\% + 20\% = 120\%$

Cost price  $\rightarrow 100\% = \text{GH}\text{c } 600,000$

$M_2^1$

Selling price  $\rightarrow 120\% = ?$

$$= \frac{120}{100} \times \text{GH}\text{c } 600,000$$

$M_2^1$

$$= \text{GH}\text{c } 720,000$$

A1

alternatively

$$SP = CP + \text{Profit}$$

$$= 600,000 + \left(\frac{20}{100} \times 600,000\right)$$

$$= \mathbf{600,000 + 120,000}$$

$$= \mathbf{\text{GH}\text{c } 720,000}$$

(ii) VAT =  $5\frac{1}{2}\%$  of selling price

$$= \frac{11}{200} \times \text{GH}\text{c } 720,000$$

$M_2^1$

$$= 11 \times \text{GH}\text{c } 3600$$

$M_2^1$

$$= \text{GH}\text{c } 39,600$$

A1

New selling price after the introduction of  $5.5\%$  VAT on selling price, maintaining the same profit

$$= \text{VAT} + \text{Old Selling Price}$$

$$= 39600 + 720000$$

$$= \text{Ghc } 759,600$$

(d) Translation vector = Image – Point

$$= \begin{pmatrix} 3 \\ -2 \end{pmatrix} - \begin{pmatrix} 2 \\ 5 \end{pmatrix}$$

$M_2^1$

$$= \begin{pmatrix} 3-2 \\ -2-5 \end{pmatrix}$$

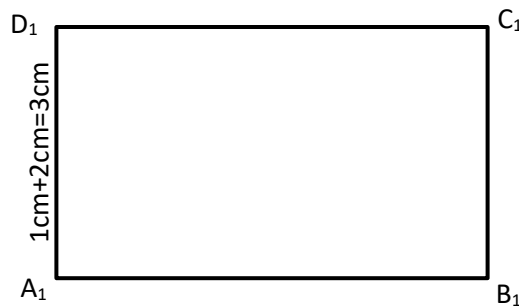
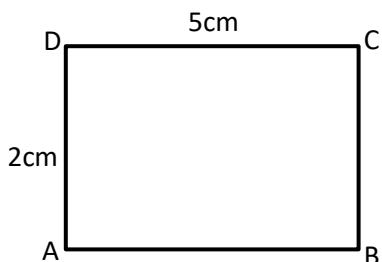
$$\text{Translation vector} = \begin{pmatrix} 1 \\ -7 \end{pmatrix}$$

$A_2^1$

**TOTAL = 15 MARKS**

## QUESTION TWO

(a)



$$\text{Scale factor} = \frac{\text{length in the image}}{\text{length in the object}}$$

M1

$$= \frac{|OA_1|}{|OA|}$$

$$= \frac{3\text{cm}}{2\text{cm}}$$

M1

$$= 1.5\text{cm}$$

A1

(b) VAT paid = GHc 100

$$\text{VAT rate} = 12\frac{1}{2}\% = 12.5\%$$

$$\text{VAT Exclusive cost rate} = 100\%$$

$$\text{VAT Exclusive cost} = \frac{100\%}{12.5\%} \times \text{GH}\text{c } 100.00$$

M1

$$= \frac{100}{12.5} \times \text{GH}\text{c } 100.00$$

$$= \frac{\text{GH}\text{c } 10000}{12.5}$$

M1

$$\text{VAT Exclusive Cost} = \text{GH}\text{c } 800.00$$

A1

$\therefore$  The VAT Exclusive cost of the items is GHc 800.00

alternatively

Given VAT paid = Ghc 100

VAT% = 12.5

Let Cost of items, excluding VAT = CP

$$\Rightarrow \text{VAT}\% = \frac{\text{VAT}}{\text{CP}} \times 100$$

$$12.5 = \frac{100}{\text{CP}} \times 100$$

$$12.5 \times \text{CP} = 10000$$

$$\text{CP} = \frac{10000}{12.5}$$
$$= 800$$

$\therefore$  Excluding VAT, the items cost Ghc 800

(c) Percentage gain =  $\frac{\text{Selling price} - \text{Cost price}}{\text{Cost price}} \times 100\%$  M1

$$= \frac{\text{GH}\text{c } 65,000 - \text{GH}\text{c } 55,000}{\text{GH}\text{c } 55,000} \times 100\%$$
 M1

$$= \frac{\text{GH}\text{c } 10,000}{\text{GH}\text{c } 55,000} \times 100\%$$

Percentage gain = 18.18% A1

(d) (i) Scale Factor (k) =  $\frac{\text{image length}}{\text{object length}}$  M1

$$= \frac{|OY^1|}{|OY|}$$
$$= \frac{10\text{cm}}{6\text{cm}}$$
 M1

$$k = \frac{5}{3}$$

$\therefore$  The scale factor of the enlargement is  $= \frac{5}{3}$  or 1.67 A1

(ii)  $|OX^1| = K \times OX$  M1

$$= \frac{5}{3} \times 4\text{cm}$$

$$= \frac{20\text{cm}}{3}$$
 M1

$$= 6.67\text{cm}$$
 A1

**TOTAL = 15 MARKS**

**QUESTION THREE**

(a)	(i)	Stem	Leaf
		0	6, 8
		1	0, 2, 8
		2	2, 6, 7
		3	1, 6, 7, 9
		4	2, 3, 4, 7, 8
		5	3, 5, 9

(ii) P( Student scored between 40 and 50)  $= \frac{5}{20}$  M1

$$= \frac{1}{4}$$
 A1

(accept 0.25 or 25%)

(iii) n(students who passed) = 4+5+3 = 12 M1 (at least 2 terms)

A1 (accept jumping)

(b) Mean =  $\frac{\Sigma x}{n}$

$$9 = \frac{8+11+8+19+6+7+3x+11+11}{9}$$

$$9 \times 9 = 8 + 11 + 8 + 19 + 6 + 7 + 11 + 11 + 3x$$
 M1

$$81 = 81 + 3x$$

$$81 - 81 = 3x$$

$$\frac{0}{3} = \frac{3x}{3}$$

$$0 = x$$

$$\therefore x = 0$$

M1

A1

- (c) (i)  $X = \{2, 3, 5, 7, 11\}$   
 $Y = \{1, 3, 5, 7, 9, 11\}$   
(ii)  $X \cap Y = \{3, 5, 7, 11\}$   
(iii)  $X \cup Y = \{1, 2, 3, 5, 7, 9, 11\}$

B<sup>1</sup>/<sub>2</sub>

B<sup>1</sup>/<sub>2</sub>

B<sup>1</sup>/<sub>2</sub>

B<sup>1</sup>/<sub>2</sub>

(d) Object Length =  $\frac{\text{Image length}}{k}$

$$|AD| = \frac{|A^1D^1|}{k}$$

$$= \frac{12\text{cm}}{1/4}$$

$$= 12\text{ cm} \times 4$$

$$|AD| = 48\text{cm}$$

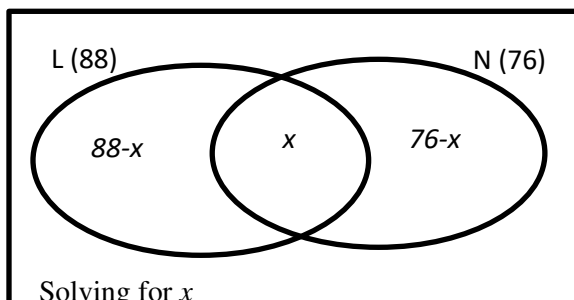
M<sup>1</sup>/<sub>2</sub>

A<sup>1</sup>/<sub>2</sub>

**TOTAL = 15 MARKS**

**QUESTION FOUR**

(a) (i)



B2

Solving for x

$$(88 - x) + x + (76 - x) = 100$$

$$88 + 76 - x = 100$$

$$164 - x = 100$$

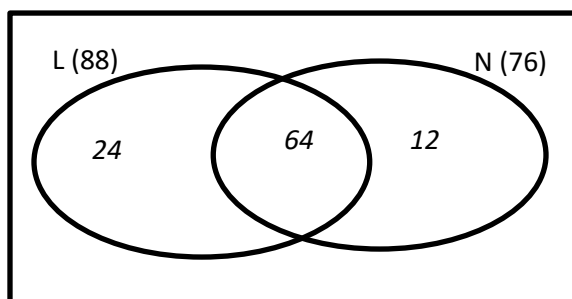
$$x = 100 - 164$$

$$x = 64$$

M<sup>1</sup>/<sub>2</sub>

M<sup>1</sup>/<sub>2</sub>

A<sup>1</sup>/<sub>2</sub>



B2

- (ii) Percentage of persons who passed exactly one subject  
 $= 24 + 12$   
 $= 36$   
Probability that a person chosen at random passed exactly one subject  
 $= 36\% = \frac{9}{25}$

M<sup>1</sup>/<sub>2</sub>

A<sup>1</sup>/<sub>2</sub>

M<sup>1</sup>/<sub>2</sub>

A<sup>1</sup>/<sub>2</sub>

- (b) (i) Gross income = GH¢ 120, 000.00  
His tax free allowance = GH¢ 1, 500.00  
Income tax rate = 15%

Taxable income = Gross income – Tax Free allowance

$$\text{Taxable income} = \text{GH}\text{¢ } 120,000.00 - \text{GH}\text{¢ } 1,500.00$$

$$= \text{GH}\text{¢ } 118,500.00$$

M<sub>2</sub><sup>1</sup>  
A<sub>2</sub><sup>1</sup>

Income Tax = Tax rate × Taxable income

$$= \frac{15}{100} \times \text{GH}\text{¢ } 118,500.00$$

$$= 15 \times \text{GH}\text{¢ } 118,500.00$$

M<sub>2</sub><sup>1</sup>  
A<sub>2</sub><sup>1</sup>

Income tax = GH¢ 17, 775.00

∴ He is liable to GH¢ 17, 775.00 tax payment

A<sub>2</sub><sup>1</sup>

(c) Cost Price = GH¢ 125.00

Profit = 30%

$$\text{Selling price (S. P)} = \frac{100+P\%}{100\%} \times \text{Cost price (C. P)}$$

$$= \frac{100+30}{100} \times \text{GH}\text{¢ } 125$$

$$= \frac{130}{100} \times \text{GH}\text{¢ } 125.00$$

$$= \frac{13}{10} \times \text{GH}\text{¢ } 125.00$$

$$= \text{GH}\text{¢ } \frac{1625}{10}$$

$$\text{Selling price (S. P)} = \text{GH}\text{¢ } 162.50$$

B ½

M1

M1

A½

*alternatively*

$$SP = CP + \text{Profit}$$

$$= 125 + \left(\frac{30}{100} \times 125\right)$$

$$= 125 + 37.5$$

$$= \text{GH}\text{¢ } 162.50$$

(d)  $Q \cup T = \{1, 2, 3, 4, 5, 6, 7, 10, 11, 12, 15\}$

$$Q \cap T = \{1, 3, 5, 11\}$$

M1

A1

TOTAL = 15 MARKS

### QUESTION FIVE

(a) (i) and (ii) Refer to graph

(iii) A (2, 1)      B (3, 4)      C (4, 2)

(iv) Enlargement under a scale factor 2 from the origin

$$(x, y) \rightarrow k(x, y)$$

$$A (2, 1) \rightarrow A_1 2(2, 1)$$

$$B (3, 4) \rightarrow B_1 2(3, 4)$$

$$C (4, 2) \rightarrow C_1 2(4, 2)$$

$$A (2, 1) \rightarrow A_1 (4, 2)$$

$$B (3, 4) \rightarrow B_1 (6, 8)$$

$$C (4, 2) \rightarrow C_1 (8, 4)$$

$$A_1 (4, 2)$$

$$B_1 (6, 8)$$

$$C_1 (8, 4)$$

(v) Using the x – axis as the mirror line

$$(x, y) \rightarrow (x, -y)$$

$$A (2, 1) \rightarrow A_2 (2, -1)$$

$$B (3, 4) \rightarrow B_2 (3, -4)$$

$$C (4, 2) \rightarrow C_2 (4, -2)$$

$$A_2 (2, -1)$$

$$B_2 (3, -4)$$

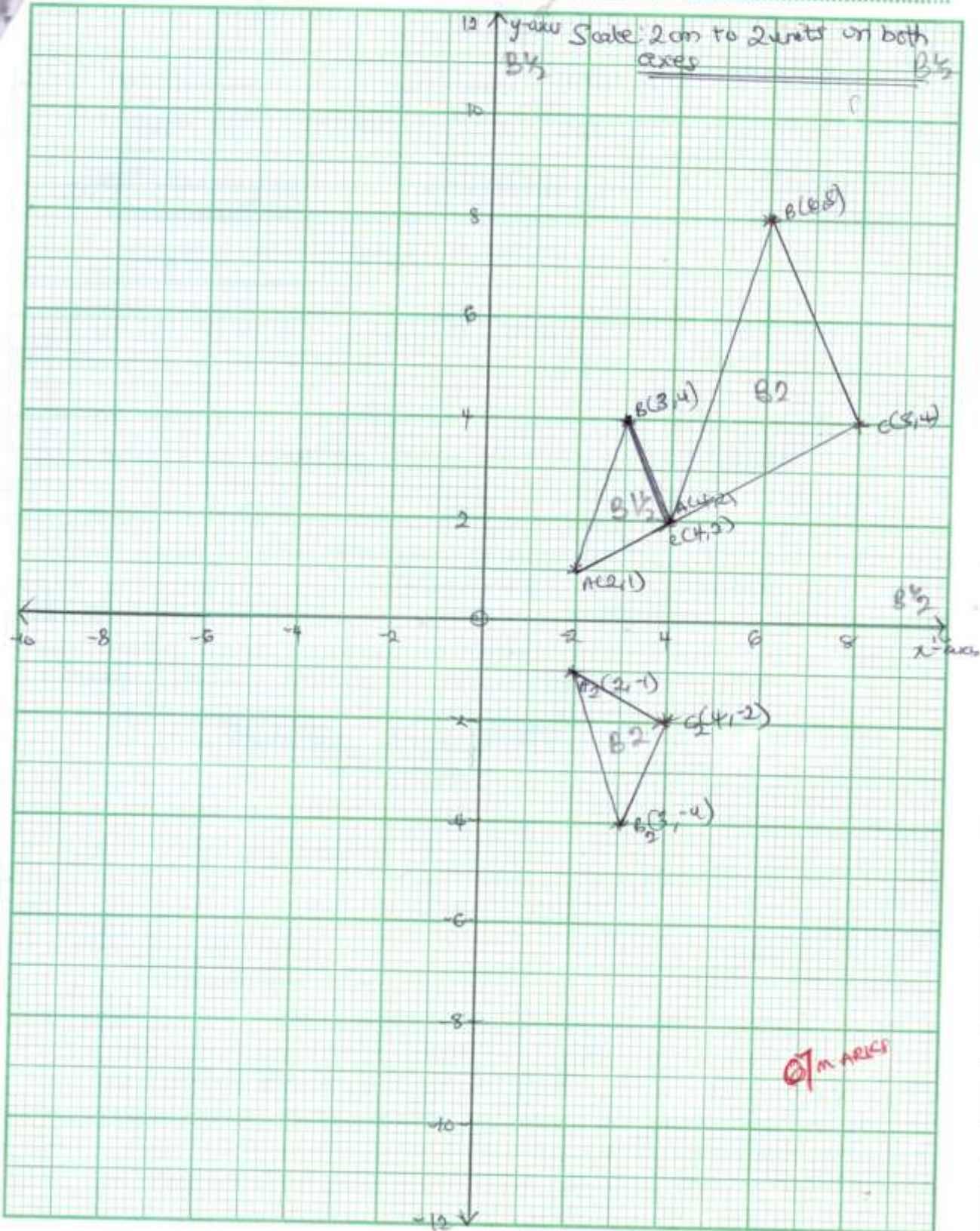
$$C_2 (4, -2)$$

**Penalties**

- Wrong/non-labeling of vertices
- Non-joining or non use of straight edge
- Non-calibration of axes
- Non-labelling of axes

QUESTION 4(a)  
(To be fastened together with other answers to paper)

Name: ..... Index Number: .....



(b)  $n(\text{STUDENT}) (\text{outcome}) = 7$   
 $n(\text{Ts}) = T, T=2$   
 $P(\text{Ts}) = \frac{2}{7}$

**B** $\frac{1}{2}$   
**A** $\frac{1}{2}$

(c) Given  $P = \{2, 3, 4, 5, 6\}$   
 Let  $S =$  set of all possible outcomes of selection of two distinct numbers  
 $n(S) =$  number of elements in  $S$   
 $\Rightarrow S = \{(2,3), (2,4), (2,5), (2,6), (3,4), (3,5), (3,6), (4,5), (4,6), (5,6)\}$   
 $n(S) = 10$

**B** $\frac{1}{2}$

(i) Let  $E =$  event that the sum of two numbers is 8  
 $n(E) =$  number of elements in  $E$   
 $E = \{(2,6), (3,5)\}$   
 $n(E) = 2$

Probability that the sum of the two numbers is,  $P(E) = \frac{n(E)}{n(S)}$   
 $= \frac{2}{10} = \frac{1}{5}$

**M** $\frac{1}{2}$   
**A** $\frac{1}{2}$

(ii) Let  $E =$  event that one of the two numbers selected is a factor of the other  
 $\Rightarrow E = \{(2,4), (2,6), (3,6)\}$   
 $n(E) = 3$

Probability that one of the two numbers selected is a factor of the other

$P(E) = \frac{n(E)}{n(S)}$

**M** $\frac{1}{2}$

$P(E) = \frac{3}{10}$

**A** $\frac{1}{2}$

**TOTAL = 15 MARKS**

**QUESTION SIX**

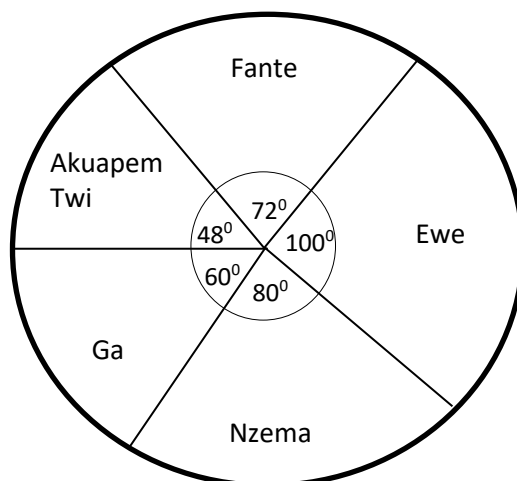
(a) Total number of People =  $12 + 18 + 25 + 20 + 15 = 90$

Angle of a sector =  $\frac{\text{category value}}{\text{total category}} \times 360^\circ$

**B** $\frac{1}{2}$

Ghanaian Language	Number of People	Angle of a sector
Akuapem Twi	12	$\frac{12}{90} \times 360^\circ = 48^\circ$
Fante	18	$\frac{18}{90} \times 360^\circ = 72^\circ$
Ewe	25	$\frac{25}{90} \times 360^\circ = 100^\circ$
Nzema	20	$\frac{20}{90} \times 360^\circ = 80^\circ$
Ga	15	$\frac{15}{90} \times 360^\circ = 60^\circ$
<b>TOTAL</b>	<b>90</b>	<b>360°</b>

**Title: A pie chart showing the distribution of people who speak some Ghanaian Languages**



**B3**

- (ii) Probability of selecting a person who speaks Ga =  $\frac{n(Ga)}{n(S)}$   
 $= \frac{15}{90}$  **M1**  
 $= \frac{1}{6}$  **A1**
- (iii) The Modal Ghanaian Language is Ewe. **B1**

- (b)  $S(-5, -3)$
- (i)  $270^\circ$  clockwise  $\Rightarrow (-y, x)$   
 $S(-5, -3) \Rightarrow S_1(3, -5)$  **B $\frac{1}{2}$**
- (ii)  $180^\circ \Rightarrow (-x, -y)$   
 $S(-5, -3) \Rightarrow S_1(5, 3)$  **B $\frac{1}{2}$**
- (iii)  $90^\circ$  clockwise  $\Rightarrow (y, -x)$   
 $S(-5, -3) \Rightarrow (-3, 5)$  **B $\frac{1}{2}$**

- (c) Scale factor (k) =  $\frac{\text{image length}}{\text{object length}}$   
 $= \frac{|LM|}{|CD|}$  **M1**  
 $= \frac{18\text{cm}}{3\text{cm}}$  **A1**  
 $k = 6$

- k which represents  $|LQ|$   
 $k = \text{scale factor} \times |DE|$   
 $k = 6 \times 2\text{cm}$  **M1**  
 $k = 12\text{cm}$  **A1**

- (d) Monthly income = GH¢ 3, 600.00  
Tax – free allowance = GH¢ 350.00  
Taxable income = Monthly income – Tax free allowance **M1**  
 $= \text{GH¢ } 3, 600.00 - \text{GH¢ } 350.00$  **M1**  
Taxable income = GH¢ 3, 250.00 **A1**

**TOTAL = 15 MARKS**

**PAPER 1 [40 MARKS]**

- |              |              |              |              |
|--------------|--------------|--------------|--------------|
| 1. <b>B</b>  | 11. <b>A</b> | 21. <b>D</b> | 31. <b>D</b> |
| 2. <b>C</b>  | 12. <b>B</b> | 22. <b>C</b> | 32. <b>A</b> |
| 3. <b>B</b>  | 13. <b>C</b> | 23. <b>D</b> | 33. <b>A</b> |
| 4. <b>B</b>  | 14. <b>D</b> | 24. <b>A</b> | 34. <b>C</b> |
| 5. <b>A</b>  | 15. <b>A</b> | 25. <b>A</b> | 35. <b>D</b> |
| 6. <b>B</b>  | 16. <b>A</b> | 26. <b>B</b> | 36. <b>A</b> |
| 7. <b>A</b>  | 17. <b>D</b> | 27. <b>C</b> | 37. <b>D</b> |
| 8. <b>D</b>  | 18. <b>B</b> | 28. <b>B</b> | 38. <b>D</b> |
| 9. <b>A</b>  | 19. <b>A</b> | 29. <b>C</b> | 39. <b>D</b> |
| 10. <b>B</b> | 20. <b>D</b> | 30. <b>D</b> | 40. <b>A</b> |

1 X 40 = 40 MARKS